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A Project for Phytogeographic Nomenclature*

BY CH. FLAHAULT

The rôle of botanic geography is relatively simple. Whatever may be the extent of the territory considered, it proposes to establish statistics of the species which inhabit it, investigate their origin, their migrations and their present and former distributions. It is desirable that in immense countries like the United States of North America, or Russia, on a desert island or in a province, writers may be enabled to employ the same terms to designate the various subdivisions of importance without being misunderstood. Russian botanists divide all the European territory of the Czar's empire into four regions; a recent author recognized six in the little island of Lesbos, the extent of which does not exceed several square kilometers.

While it is unfortunate in some respects that the meaning of a word lacks precision, the subject itself explains enough of that which is in question to cause no serious trouble in the variation of the interpretations; it is easy to return to the subject in question.

This incoherency is the more to be regretted when it occurs in works on botanic geography. Phytogeography becomes more and more an exact science; its principal aim is to make known the multiple relations of vegetation to an environment however varied. To express these relations it is important, then, that we have an all-sufficient vocabulary on which those interested would agree. This is an essential condition to all progress. Now, the greatest disorder prevails in works on the subject of nomenclature and on the subordination of geographic groups. Some use the same term promiscuously for great extents of country and for elevated mountain zones. For some, zones are tracts of land characterized by forms of vegetation peculiar to plains, while regions are applied to the mountains; they say forest region, subalpine, alpine, nival regions, etc. For others, regions are territories in the plains distinguished by peculiar vegetative and floral characters;

* Translation of a paper read by Professor Flahault at the International Botanical Congress, Paris, October, 1900.

region of the steppes, region of coniferous forests, etc. This idea of botanic region, so diversely interpreted, designates geographic units of a superior class, or it is not subordinated to others according to the meaning given it, so that the names of regions, provinces, zones, districts, sectors, etc., designate very different things according to the authors who use them.

A. Engler* has adopted a series of names for phytogeographic units of different classes; but he has not been followed by the majority of botanists, notwithstanding the authority of his writings, as possibly this series does not meet with the requirements of a science which demands more and more precision. Without any doubt, in 1879, Engler did not pretend to regulate a question of method, not wishing to establish a code of phytogeographic nomenclature, *ne varietur*. He intended, it seems to me, only to express clearly the facts which are the object of his memoir; he has chosen the terms that he employs, simply because they appear the most convenient to him, without discussing all their advantages or inconveniences.

The time has come when it appears necessary that a technical terminology should be established or we shall no longer understand each other. A comparison of facts will be facilitated if we adopt a common basis and a sufficient uniformity of expression. We will be enabled to compare comparable units if we restrict the same name for units of the same value. We will be able under these conditions to speak of the temperate regions with or without a dry season; we will be able to draw a parallel between the Mediterranean, Australian, Cape, Californian and Chilian *regions*, the desert *domains* of northern Africa, of western and central Asia, of Australia, of Colorado and Mexico, the *district* of the Vosges and of the Maures, the subalpine and alpine *zones* of the Alps, the Pyrenees and the Caucasus, etc. Dr. O. Warburg, at the geographic congress of Berlin insisted on the necessity of such an understanding as soon as possible.

This article does not pretend to solve the problem; but if the time has come for a statement, the Botanical Congress furnishes an opportunity which must not be allowed to pass. It does not appear useless, at all events, to propose some principles and to advance

* A. Engler, Versuch einer Entwicklungsgesch. der extratrop. Florengebiete.

some ideas, in order to elicit thoughtful discussion, here and elsewhere.

Phytogeographic nomenclature may be applied to two different things :

1. To geographic and topographic substrata of vegetation, *i. e.*, to *geographic and topographic units*.
2. To vegetation itself, grouped in different ways, according to conditions of climate and environment, *i. e.*, to *biologic units*.

Let us then direct our attention to the first.

I. NOMENCLATURE OF GEOGRAPHIC AND TOPOGRAPHIC UNITS

It will be expedient to take as the basis of fundamental divisions, essential facts which dominate all others and which are incontestable in themselves and in their reactions on vegetable life.

The general relations of vegetation to the fundamental conditions of climate need no discussion here. Prof. Drude* was right when he endeavored to represent the fundamental climatic data in such a way as to correlate essential biologic facts with their determining causes. Our lithosphere may thus be subdivided by lines more or less parallel to the equator, into zones distinctly characterized at the same time by climate and by the vegetation which is its expression. In cold countries there is a corresponding form of vegetation, plants of small size with highly developed underground organs, etc. ; plants which inhabit them resist very low temperatures during their period of rest, and even during their vegetative period endure temperatures below 0° C.; these are microthermal plants. In warm countries there are corresponding plants which require very high temperatures, perishing at 0° C. or even at temperatures above freezing point; many of them have their activity scarcely interrupted. These are macrothermal vegetations. In temperate countries there are plants which undergo a periodical rest, and which alternately endure low and high temperatures; these are mesothermal.

It is natural then to divide the terrestrial globe into cold, temperate and warm zones, as did William Schimper † following Grisebach. Without becoming unintelligible, distinction may be made

* Drude, Manuel, p. 69, pl. iv.

† Schimper, Pflanzengeographie, 227.

between the cold and temperate zones according to the hemisphere which they occupy. Prof. Drude has done this for the general grouping of the regions of vegetation in publishing sheet 46 of Berghaus' Physical Atlas.

This grouping is only of general value. It permits a first separation, a division of the earth comprehensible to persons who are not prepared for special study. It is destined only to facilitate subsequent grouping, to render it even possible. The tropics are not the limits of the tropical flora; the Arctic circle does not indicate exactly where certain floras either commence or end; for which reasons it seems preferable to express the most important climatic character of each of these zones, to distinguish them simply under the names of warm, temperate and cold (in place of tropical, temperate and arctic). In this case, the word zone is used in the sense that is generally given it in French.

The definition of zone exactly applies to these units of the first order; they are divisions of the sphere's surface included between two parallel lines; this is the signification of the word as adopted by meteorologists, but it seems impossible to us not to apply it to the belts following which the mountain flora becomes divided. Another term cannot be found to replace it; that is why this point will have to be reconsidered later.

The great warm, temperate and cold zones are respectively divided into less important groups. Climatic causes combine in each fundamental zone in different methods, to effectuate, on the whole, very different climates, to allow the development of vegetation of varied aspect and composition. The differences in the character of vegetation of two neighboring countries explains the dissimilarity of their climates, and their resemblance is the expression of their joint climatic factors. In other words, a like ensemble of climatic conditions combining in the same way determines a like *type of vegetation*; other conditions, or only another division of the same conditions, give occasion for the development of types of different vegetation. So it is that the vegetative type of our western Europe is that of the forest composed of trees with deciduous leaves; while that of eastern Europe is the steppe; that of the warm and constantly humid climate of the tropics, is the forest which is always green.

Thenceforth, the fundamental climatic zones divide naturally into large natural *regions of vegetation*. When studying the flora of the world, this division is the most apparent, and it is the most important. The great regions of vegetation are great climatic regions; the map of the distribution of large natural groups coincides with the principal types of climate over the whole earth.

Martius was the first to distinguish regions (Florenreiche).^{*} A. de Candolle defined them with more precision.[†] The name has been generally adopted; there is then reason to follow tradition. A more or less broad sense has been attributed to it. We think it would be expedient to give it the import which was attributed to it by Grisebach in his principal work.[‡] The vegetative regions of Prof. Drude are the same.[§] So we say the *Forest region of northern Eurasia*, the *Temperate forest region of western Europe*, *Mediterranean region*, *Eurasiatic steppe region*. This is the proper meaning of the word in French; it expresses above everything a "large extent of country" (Littré). The great mountain masses considered as a whole and in their relations to the regions which surround them and to the entire terrestrial surface may also constitute natural regions. The entire group of the Alps constitutes the *Region of the Alps*; the *Region of the Caucasus* is distinguished in the same way, also that of the *Pyrenées*, the *Iberian group* and of the *Balkans*. It will be a question if, according to their relative importance and the relation of their vegetation to that of adjoining units, mountain groups of less importance should have the value of different subordinate units. So that we would say: the domain of the central group of France, domain of the Jura, austro-occidental domains, the central and eastern of the Alps; that we distinguish eastern, central and western sectors of the Pyrenees, the Savoie, Dauphiné, Provençal and Maritimes sectors of the Alps, the districts of the Albères, the Causses and the granitic Cévennes, etc.

The different strata of vegetation which range in echelon over the declivities add a certain number of questions to those which

^{*} Von Martius, *Historia Natur. Palmarum*, I: tab. geogr. III. and IV., 1831.

[†] A. de Candolle, *Introduction Géogr. bot.*, 1837.

[‡] Grisebach, *La Végétation du Globe*.

[§] Drude, *Manuel*, p. 302.

make up the whole, projected, as it were, on the general surface of the globe, in diversifying biologic conditions and in multiplying phytogeographic problems.

The great fundamental zones are subdivided then into vegetative regions which constitute the most important phytogeographic units. The idea of zones in general answers the need of synthesis and results from a consecutive comparison. The polar tundras appear to us a region contiguous to the forest region of northern Europe before we consider whether each of them should not be classed in a different superior group.

It being so, and because it appears necessary to reserve the name of zone to express parallel belts following which the mountain vegetation is divided, it seems advantageous to give the name of *Groups of Regions* to the fundamental zones.

So we would have a group of cold regions, one of temperate and another of warm regions ; the same could be said of groups of boreal, austral and tropical regions.

It has been said that this primary grouping has for its principal purpose the facilitating of a grouping of the second order ; it is, therefore, arbitrary ; it suffices to make it good that it depends on evident and incontestable facts.

Botanic regions may be subdivided into secondary circumscriptions of variable extent in the determination of which the variations of climate are also secondary, but which depend ordinarily on topographic and geographic conditions.

Thus in the forest region of western Europe, the Atlantic Coast countries are clearly distinguished from the lowlands bordering on the North Sea and from the valleys of the Rhine and Danube. The Mediterranean region south of the Pyrenees has not the same character as in France or in northern Africa.

To these subdivisions of regions Prof. Engler has given the name province ; in many countries this word has an administrative or political sense so that its use would give rise to ambiguities. The word *Domain* seems more appropriate.

In the forest region of western Europe there is distinguished then an *Atlantic domain*, a *domain of the plains of northern continental Europe* and one of *central Europe* ; in the Mediterranean region there are the Iberian, the Mauritanian, French domains, etc.

Domains themselves may be divided into *sectors*; secondary climatic characters interpreted by vegetation will be taken into account, but the consideration of botanic elements of which we have not had to take account until now, also intervenes. When a portion of a region or a domain may be characterized by a certain number of plants which have entered from other countries, it would constitute a *sector*. In the Atlantic domain an Aquitanian *sector* may be distinguished where there are numerous species which have immigrated from the Mediterranean region, and where these fail, an Armorican *sector*; in the French domain of the Mediterranean region, there is a Provençal *sector* where representatives from the Italian domain are abundant, Roussillon and Corbières *sectors* which have been invaded by Iberian species, notwithstanding the barrier of the Pyrenees; in the Iberian domain an Andalusian *sector* characterized by many Moorish species, etc.

A new distinction may be introduced based either on geographic or topographic causes or on the physicochemic characteristics of the soil influencing vegetation.

District, such as we understand, it together with Prof. Briquet, corresponds to the *Bezirk* of Prof. Engler.

Islands separated from adjoining land by more or less extensive arms of the sea become characterized as districts by the appearance of endemic types. Ridges, exceeding the limits of vegetation, which separate valleys, tend to give to them special characters by preventing migration and in favoring endemism. Mountain ranges of a known mineralogic composition, isolated in the center of a group of different composition, may often be distinguished as districts for the same reason. C. Schröter, John Briquet and Paul Jaccard cite excellent examples of such in the Alps.

In the French domain of the Mediterranean region there are included the calcareous *district of the lower Corbières*, the siliceous volcanic rocky *district of the Maures and the Estérel*, while that of the *Balearic Islands* with their many endemic species, makes a very distinct district in the western sector of the Iberian domain.

Subdistricts may also be distinguished if they prove useful after a careful analysis. It is possible that some day the opportunity

may be recognized of distinguishing two subdistricts in the district of the Maures and that of the Estérel, if with the mineralogic differences between the ancient and modern eruptive soils are corresponding botanic differences, which have escaped us as yet.

Prof. Briquet has distinguished several subdistricts in the western Alps and in the Jura.* In France for the same causes, and probably in all countries of ancient civilization where the soil has retained the impress of history, botanic districts often coincide accurately with the ancient "country." In mountain groups the subdivisions recognized by the inhabitants also represent the natural divisions of districts. The names of countries and of mountain groups which are used by the population may often be given to indicate districts or subdistricts without resulting error or ambiguity.

The last term remains to be spoken of, that of *station*, the final one of the series of geographic and topographic units.

In 1844, Wimmer† insisted on the necessity of adding to the morphological diagnosis of each species a phytogeographic description "which will determine with precision and in definite terms all environmental conditions; for a description of this kind contributes not less than the first to a knowledge of the species."

A station is a circumscription of any extent, but oftener limited, and represents a complete and definite ensemble of conditions of existence. Station sums up all that is necessary to the species which occupy it, the combination of climatic and geographic factors with the edaphic and biologic factors, that is to say the relation of each species to the soil and to associated species.

The disappearance or only the modification of an element, a specialization or even a very slight variation of any factor would be sufficient to determine a difference of station. The vocabulary of each country, born of the environment and need that puts a people to the test of expressing facts and phenomena which they observe each day, should furnish the means of designating stations peculiar to the country. The Scotch heaths, the Russian steppes, the moors of Brittany, the prairies of North America, the "prés-bois" of our Alps, represent peculiar forms of vegetation which

* John Briquet, Rech. sur la flore du district Savoisien, 1890.

† Wimmer, Flora der Schlesien, 1844.

may give rise to errors, for those unacquainted with them might deem it possible to correlate them with a form of vegetation of another country. It is necessary then in botanic geography to mistrust translations and not fear to adopt the name of a station which has been furnished us by the indigenous language.

The conception of Savannah as adopted and popularized by our travelers comprises, it appears, varied stations, that the ignorance of botanic geography alone makes confusing. It is important then to accept indigenous names as having a geographic value where their exact synonym is not known in one's own language.

The polar *Tundra*, the Siberian *Taïga*, the *Myrar* of the Swiss, the *Watten* of the coast of the North Sea, the *Llanos*, *carrascos*, *campos*, *potreiros* and *pinhals* of Brazil, the *scrub* of Australia have no equivalent in our language and these names have the same claim for preservation as our *garigues* and *maquis*.

It even happens (and this is the case in our own French language) that far from it being necessary to translate words given to natural features in other languages, the admitted classic vocabulary is not sufficient to explain facts and phenomena which are exhibited in a country, or the objects which are there encountered. In contrast with other languages which are profoundly penetrated by the poetry of nature, resulting from the constant contact of man with nature, our own, however literary and erudite, originating in the salons where polished society formerly gathered, has no words to express that which it has not known. It is from our old language that the words *garigue* and *maquis* have come. *Sansouïre*, *Erme*, *Casse*, *Campas* have been acquired from ancient dialects. They express things of which our literature has no idea. It is proper to so enrich our language.

In finishing the nomenclature of geographic and topographic units only a few words remain to be said to express the more or less parallel bands which different vegetations follow when they are superimposed in the altitudinal sense.

If a certain parallelism in climate exists between the regions which extend from the equator to the poles and that of mountains considered from their base to their summit, it is now known that this parallelism depends only upon the temperature of the air. Therefore there is no need for them to be confused. Now in France,

the word *zone* expresses a space which is clearly limited, as for instance that portion of a sphere's surface which is contained between two parallel lines (and accordingly this name agrees with the fundamental climatic-botanic zones) as a space is compared to a band. The word is used in this sense in geology, astronomy, meteorology and in military science. With this precise signification it expresses better than all others successive stages of vegetation from the base to the summit of mountains. In this exact sense the word has been adopted by French phytogeographers. "At an elevation of 11,000 feet, said Edmond Boissier, in 1839, one may expect to find vegetation distributed in distinct *zones* and this is what actually happens, but settling the delimitation of these *zones* offers many difficulties.* * *''* Dr. Christ has likewise adopted this French interpretation of the word *zone* when he says that "the differences which occur in the plant world when we ascend from the plain to the snow limit convey to us the principle of *zones*. It is sufficient to cast a glance even from a distance over one of the chains of our Alps to ascertain that the vegetation which covers it is separated into very distinct *zones* with well-accentuated delimitations.†

Let us sum up all that has preceded by enumerating only the series of units covering the general surface of the globe, such as we think possible to subordinate one to another :

1. **GROUP OF REGIONS.**
2. **Regions** (Martius, 1831).
3. **DOMAIN.**
4. **Sector.**
3. **DISTRICT** (Bezirk, Engler, 1879).
6. **SUBDISTRICT.**
7. **Station** (Wimmer, 1844).

The word *zone* would be applied only to those stages of vegetation which are superimposed in altitude, according to the signification given to it by Boissier in 1839.

II. NOMENCLATURE OF BIOLOGICAL UNITS

The nomenclature of biologic units is more simple *a priori*. It is necessary to recognize, however, that although the disorder

* E. Boissier, *Voyage dan le midi de l'Espagne*, 1 : 185. 1839.

† H. Christ, *La Flore de la Suisse et ses origines*, 12. 1883.

is great in the classing of geographic and topographic units, in biologic units it is extreme. To avoid being misled in this labyrinth it would be well to retrace our steps in the course that we have just followed and consider first the elementary units, those which populate stations. It is very encouraging that good works which have been published during the last few years have commenced to introduce order into the subject by making *Associations* the foundation of critical study of botanic geography.

I did not pretend to make an innovation when I insisted, in 1894, on the necessity of taking the associations of plants living in common in the same station as a starting point for phytogeographic comparisons. It is due to Humboldt that attention was first called to the importance of *Plant Associations*. In his *Essay on the Geography of Plants* * in 1807 he showed that the different associations of plants which succeed one another from the base to the summit of Chimborazo depend strictly on temperature, humidity, atmospheric pressure, etc.

In 1820, A. P. de Candolle † urged the necessity of noting all details relating to associations: the station and its local variations, the degree of frequency or rarity of plants, etc., and their grouping into societies.

This conception therefore has its history. It is necessary that the significance of the term should be precisely stated. Vegetable association is the final expression of vital competition and of adaptation to environment in the grouping of species. Plants which inhabit the same station are not only connected one with another by simple relations of coexistence, but also by a bond of reciprocal interest, for certain of them receive benefit and profit from the conditions caused by the presence of others. The term vegetable association does not imply the harmonious coöperation of diverse tendencies toward a common end of collective advantage, as in all society founded on the principle of division of labor. It applies to the bringing together of specific and morphologic forms which are foreign to one another, for the exclusive profit of each individual; they live side by side, following the conformity or diversity of circumstances that suit them, either in the actual conditions of

* Al. de Humboldt, *loc. cit.*, 1807, p. 14.

† A. P. de Candolle, *Projet d'une flore physico-géogr. de la vallée du Léman*.

the environment or in the conditions determined by the presence of other plants.

Among the species which go to make up the association, some are *dominant*, either by the action they exert on the habitat in creating, as it were the station, or because they are characteristic of the plants of the country, in the form, size, or numbers of individuals; they form then the foundation of the vegetation. Others are *secondary*, more or less isolated, as if they had been scattered over the fundamental vegetation; or else are they *subordinated* in various degrees, either because they are scarce or rare, or it may be that they cannot live except in the shelter of the first, in their shade, as epiphytes on their aerial organs, or at their expense as parasites. They can also be subordinated by the limited duration of their active life (annuals, biennials, bulbous plants, etc.). The dominating species always characterize the association.

Association, so understood, answers exactly to what we have admitted since 1893, to that which has been described as such by E. Warming, in Denmark; Kerner, in Austria; Robert Smith, in Scotland; F. Höck, in Germany; Schröter, in Switzerland.

The term *Association* (*Plant association*) has been applied to it by English-speaking botanists. Warming called it *Plantesamfund* (in Danish) *Pflanzenverein*; Kerner described it under the term of *Genossenschaft*; Höck also called it by the name of *Bestand*. There are nevertheless divergences of opinion in regard to *Association*. W. O. Schimper regards it as composed of special ecologic groups: "It is the union of plants dependent on one another, some of which have always a dependent character and are unable to live without the help of others."* He recognizes four kinds of ecologic associations of this sort—lianas, epiphytes, saprophytes and parasites; these are groups of biologic forms, not of associations as understood by A. P. de Candolle and Humboldt.

If association is the simplest biologic unit from the geographic point of view, the ultimate expression of the struggle for life and adaptation, biologic forms may be considered as elementary units from a special ecologic point of view, as species are the elementary units which the botanist employs.

Mr. Warming has brought into correlation with the state of our

* W. O. Schimper, *Pflanzengeographie*, 208. 1898.

biologic and physiologic knowledge, the term *biologic forms* (*Lebensform*, *Vegetationsform*) which was previously but vaguely understood.

Grisebach understood by it forms of the same character which may or may not have morphologic affinities. It is known now that environment influences structure; this conception has been given precision. For example, when we speak of the ericaceous form we do not intend to treat only of the physiognomy, but also of a number of details of structure of which the outward appearance is but the collective expression.

Grisebach, in giving a vague meaning to *biologic form*, did not think of defining more clearly biologic groups which had as a basis the vague definition of biologic form such as he had conceived it. In 1838 he endeavored to group them under the name of *Phytogeographic formation* (*Pflanzengeographische Formation*, *Vegetationsformation*). "Natural formation includes plants which may be very different, but which have properties and characters in common, which may be summed up by pointing out several species which exemplify the special characteristics of the whole." So understood, forest, prairie and steppe are natural formations. But taking up this definition again to introduce more and more specious distinctions, Grisebach in 1872 distinguished fifty-four formations. Prof. Drude enumerated twenty-seven in the hercynien group.* In 1896 he distributed the different forest types of Germany into fourteen formations.† Kurz saw eight formations in the forest of Burma.‡ Hult divides the vegetation of northern Finland into half a hundred formations.§ The primitive idea has disappeared; thanks to the new interpretation, the ensemble disappears under the details, the tree hides the forest.

This diversity of interpretation has caused great difficulty in expressing facts relative to botanic geography.

Our forests, whether they be composed principally of oaks or of beech, or oaks and beech trees mixed, or associated with horn-beams or maples, etc., correspond none the less to a uniform type.

* Drude, Ueber die Principien . . . 1889.

† Drude, Deutschlands Pflanzengeographie, 1896.

‡ Kurz, Forestflora of British Burma, 1877.

§ Hult, Försök till analyt. Behandling, 1881.

This is properly a same *Formation* in the primitive sense of the word. *Association* alone is modified by dominant species and with more or less extended variations that their absence or presence introduces into the relationship of members of the association. Our "moors" of the north and west constitute a formation of the same kind, where the dominating species may be either *Calluna vulgaris* or *Erica cinerea*. Our "maquis" are of infinite variety, a score of the 70 ligneous species of which they are composed may be either dominant or subordinate according to local circumstances.

It is necessary then to distinguish between *Formation* in the broad primitive sense given to it by Grisebach, and formations such as he understood them later. The latter are associations characterized by a physiognomic type instead of by dominant species. But as the most prominent physiognomic type is more often represented by dominant species, it often happens that formation, so understood, corresponds perfectly to association as we have defined it.

Drude, Beck, Kerner, Warming admit the broad sense but with various delimitations; R. Hult, Stebler and C. Schröter agree to the narrower sense of the term. Others complying with the same variations of the definition as Grisebach, have allowed intermediate interpretations.

The result is that for some the definition of *Formation* answers to a general type, as the Forest, while for others it has a special import; the forest then comprises a great many different *Formations*.

This is not all. If in Grisebach's first definition, formation had a purely physiognomic import, if the same word denotes an ensemble of extended or restricted vegetation, the confusion is increased on account of many authors wishing to give it a special signification.

Some, in fact, have reserved for formation a descriptive physiognomic sense, while others, attempting to determine the relations of cause to effect, gave to it a topographic or ecologic sense. For example, W. Schimper considers a formation to be an assemblage of plants determined by qualities of the soil; there are therefore climatic and edaphic formations. Some even interpose origin in the definition of formation, as for example, Celakovsky regards a for-

mation as a group of species which have entered a country at the same time,

It is not to be marveled at that several botanists, who had doubtless lost their way in this confusion, acknowledge having employed the word without thinking of its definition, because others had previously made use of it.

It has not been possible to enumerate all the opinions as to the meaning of the word *formation*. Between the two extremes, the first interpretation by Grisebach and that of R. Hult there is a scale of infinite shades of meaning. The confusion is like that of a labyrinth.

Kerner, however, accepted the word as a necessity "because it had been introduced into science," notwithstanding the fact that he considered it badly chosen. Warming refrained from using it and Robert Smith has followed his example; his works have gained thereby a decided clearness.* We ask that phytogeographers make a decision, but in the meantime when they speak of formation we also ask that they say exactly what they mean by it.

Meanwhile, we readily describe the word *Vegetation* as an indeterminate grouping, as proposed by Warming.

With Warming, the designation of *Group of associations* (*Verinsklasse*) will be reserved for the designation of several associations subjected as a whole to the same general conditions of environment. The association of beech, of peduncled oak, and of the intermingled forests of our plains, etc., form a *Group of associations of tropophilous trees*. The association of *Pinus sylvestris*, of *P. maritima* and *P. Cembra*, of spruces, etc., form a *Group of associations of resinous trees with persistent foliage*.

The following groups of associations are distinguished in France:

Non-resinous trees with persistent leaves (cork and evergreen oaks).

Coniferous trees with deciduous leaves (larch).

Resinous trees intermingled with other foliage (beech and spruce, beech and Norway spruce, Norway spruce and birch).

Resinous trees and non-resinous trees with persistent leaves (evergreen oaks and Aleppo-pine, cork oak and *Pinus maritima*).

* Rob. Smith, Plant Association of the Tay Bassin, 1898. On the study of Plant Association, 1899. Botanical Survey of Scotland, 1900.

Shrubs and shrubbery with persistent leaves (garigues and maquis).

Ericaceous shrubs (heather, etc.), etc.

There are continuous groups of homogeneous associations (*geschlossene Formation*) and interrupted groups of associations (*offene Formation*) whose elements are distant from one another, dissociated, as the trees in the "prés-bois" of larches, the thickets in the Mediterranean garigues, the brush wood in the Brazilian campos, the tufts of grass on gravelly shores or on the dunes of the sea coast. The vegetation may be so thinly scattered that the name of the group of associations may be given it by the substratum.

In this way groups of plant associations could be distinguished as of the dunes and beaches of the sea coast, of rocks, of moraines, of the banks of streams and rivers, etc. These details may be easily stated in an exact manner.

Groups of associations may themselves be distributed into large ecologic series based on the uniformity of the factors which determine them, as proposed by M. Warming. There would be series of hydrophilous, xerophilous, halophilous, mesophilous groups of associations which would be designated simply by their substantives: Hydrophytes, xerophytes, halophytes, mesophytes. On this point phytogeographers have but to follow the excellent principles laid down by Warming.*

The great phytogeographic regions are characterized by a peculiar vegetable landscape, by a *type of vegetation* which reflects a distinct result of the reaction of the climate on the plants. Specific units assume the same appearance or a small number of distinct appearances; they resemble one another in aspect, height and form. The tree vegetations of temperate Europe, of North America, of China and Japan have all the same appearance. They belong to the same *type of vegetation*. The herbaceous plants of the Steppe, however different they may be from the specific point of view, have everywhere the same aspect; the tropical forest with its multiple heights of vegetation, its lianas, its epiphytes, its herbaceous carpet of infinite variety, still represents wherever it is seen, the same type of vegetation.

* Warming, Lehrbuch der oekol. Pflanzengeogr., p. 114.

Good common sense has distinguished by special terms the sum of biologic characters appropriate to each of these types. Science has but to accept them. Trees with deciduous leaves, trees with persistent leaves, shrubs, lianas, mangroves, epiphytes, fleshy plants, herbs, mosses, lichens, algae (independent of all systematic consideration) are types of vegetation. These ecologic groups represent biologic units of the first order. As we have done for geographic and topographic units, let us enumerate the series of phytogeographic terms of biologic order such as it appears possible for us to establish.

1. **TYPE OF VEGETATION** ecologic, denominated as in ordinary usage.
2. Ecologic **series of Groups of associations** expressed by a substantive: hydrophytes, xerophytes, etc. (Warming, 1894).
3. **GROUPS OF ASSOCIATIONS** (Vereinsklasse, Warming, 1894 = Formations, Schimper, 1898, Grisebach, in part).
4. **ASSOCIATIONS** (Al. de Humboldt, 1807. A. P. de Candolle, 1820 = Formations, Grisebach, 1872).
5. *Biologic form*; this is the simplest ecologic unit, as station is the elementary topographic unit.

I will have attained my aim if the suggestions which I have endeavored to group provoke discussion and influence all those who are inconvenienced by the disorder of phytogeographic nomenclature to agree to put an end to it.

The botanical congress will, perhaps, deem it expedient to commit the care of studying this question to a commission composed of the principal phytogeographers of different countries and invite them to pursue an inquiry, the conclusions of which could be submitted to a subsequent congress. Phytogeographers are unanimous in recognizing the importance of an agreement as soon as possible; we entreat them to be willing to unite their good offices with that object in view.

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